Ambient Learning Displays

Distributed Mixed Reality Information Mash-ups to support Ubiquitous Learning

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celstec.org

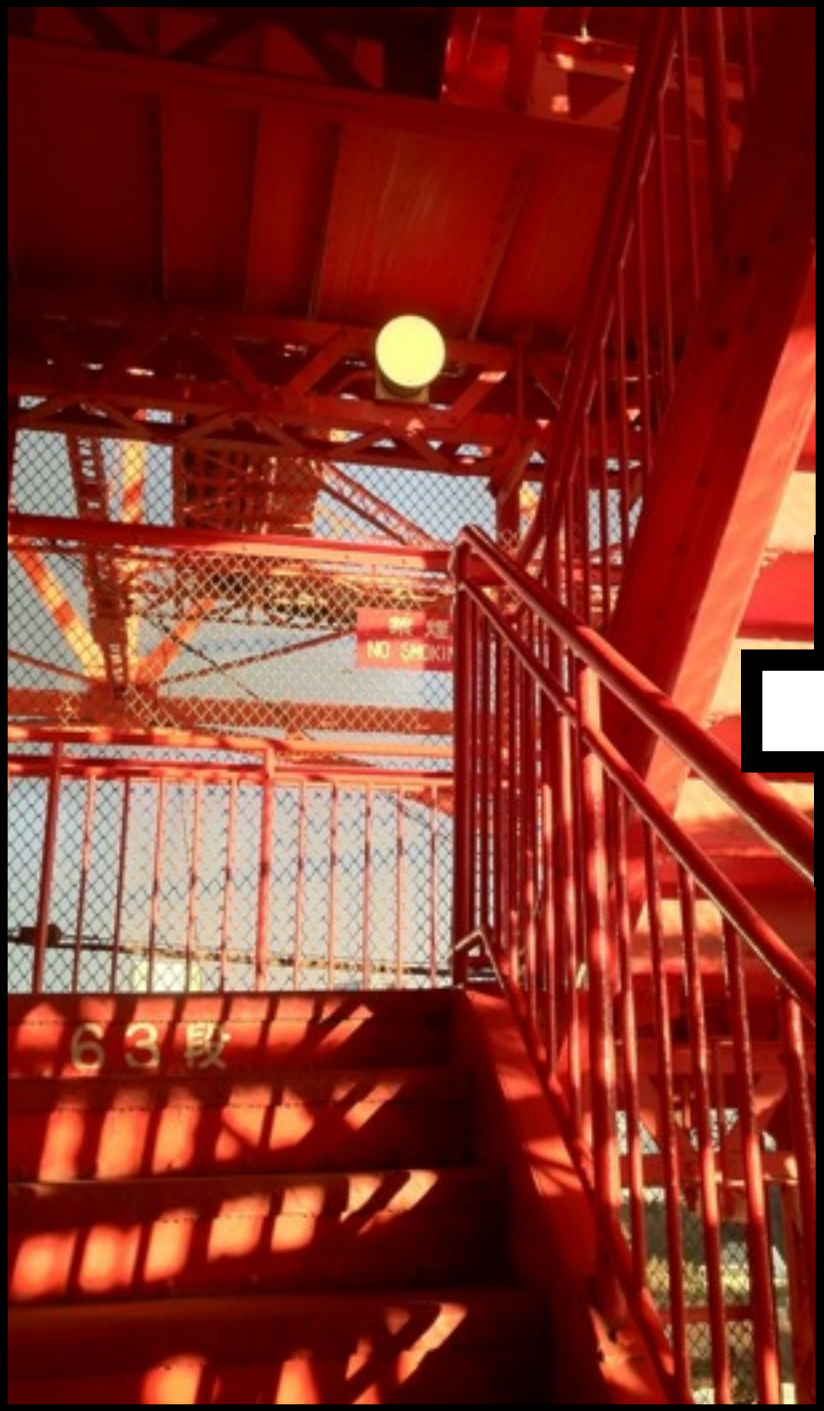
Laboratory

The adjective ambient is defined as "**relating to the immediate surroundings of something**" or "relating to or denoting advertising **that makes use of sites or objects other than the established media**" (Oxford Dictionaries, 2010), while the noun display is among others defined as "**a collection of objects arranged for public viewing**", but also as "**an electronic device for the visual presentation of data or images**" (Oxford Dictionaries, 2010).

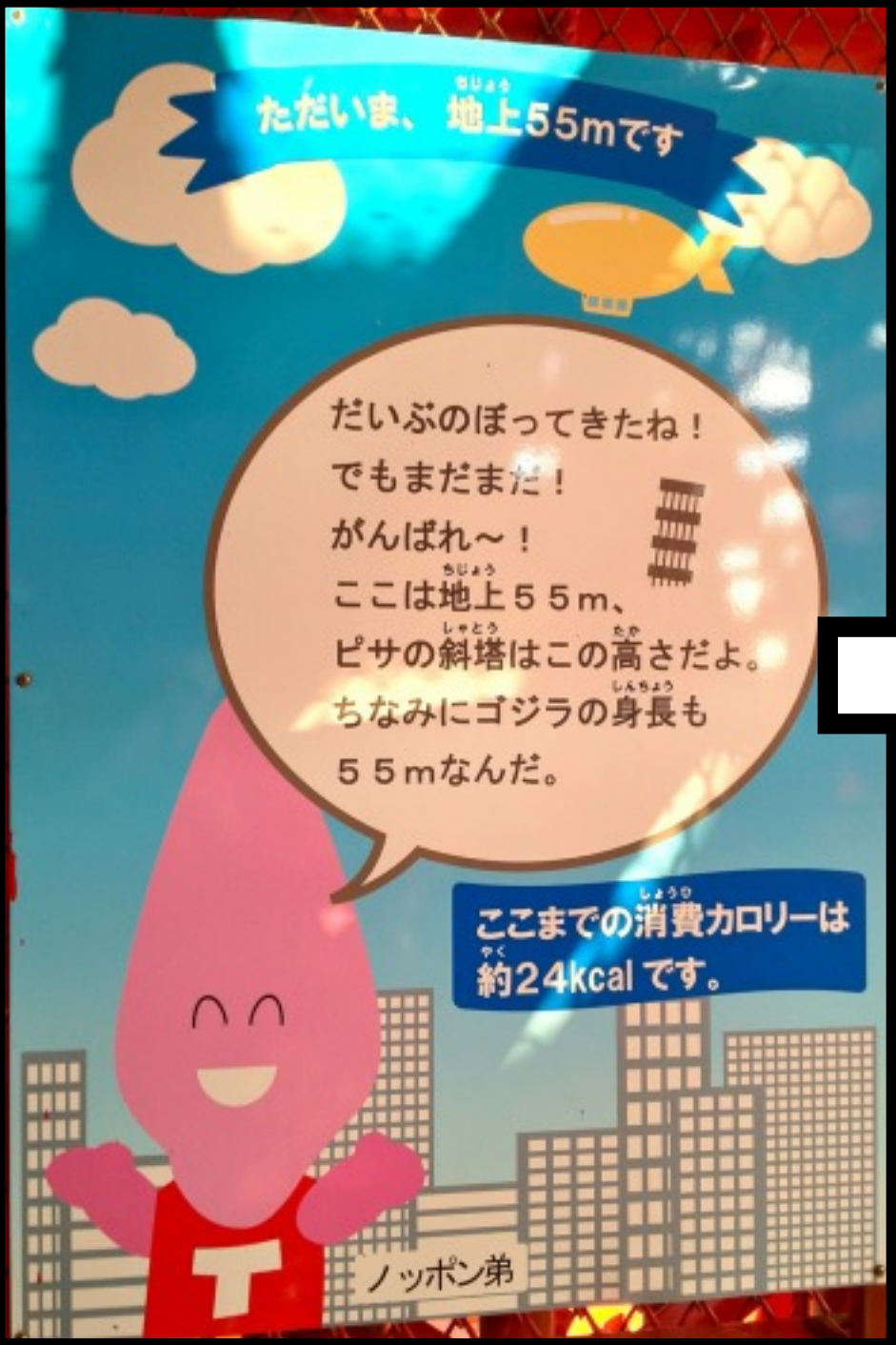
Wisneski et al. introduced ambient displays as "**new approach to interfacing people with online digital information**" (Wisneski et al., 1998). Inspired by Weiser's vision of ubiquitous computing (Weiser, 1993) the "**information is moved off the screen into the physical environment, manifesting itself as subtle changes in form, movement, sound, colour, smell, temperature, or light**" (Wisneski et al., 1998).

Definition

Tokyo Tower


63段


地上150mまで、
600段の旅を
満喫してくれ！
階段はここから
スタート！
景色を楽しみながら
のぼってね！
ノッポン弟


ただいま、地上55mです
だいぶのぼってきたね！
でもまだまだ！
がんばれ～！
ここは地上５５m、
ピサの斜塔はこの高さだよ。
ちなみにゴジラの身長も
５５mなんだ。
ここまでの消費カロリーは
約24kcal です。
ノッポン弟


ただいま、地上70mです
ココでやっと半分だ！
最後までいけるのかぁ？
そこのオカンも
がんばれよ！
ここまでの消費カロリーは
約35kcal です。
ノッポン兄

ただいま、地上90mです

だいぶ高くなってきたでしょ。
景色をたのしみながら
ゆっくりのぼってね！

ここまでの消費カロリーは
約48kcalです。

ノッポン弟

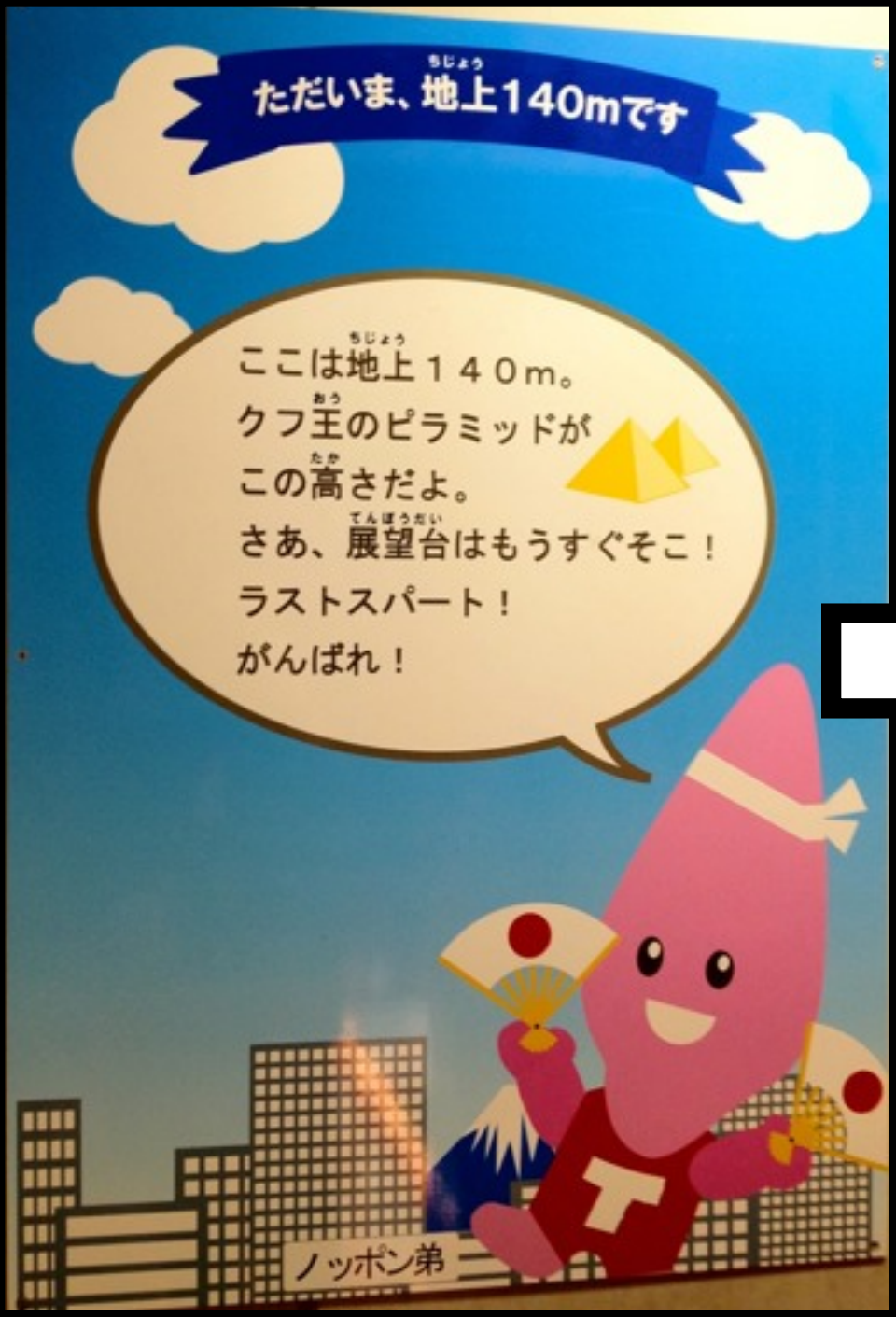
ただいま、地上115mです

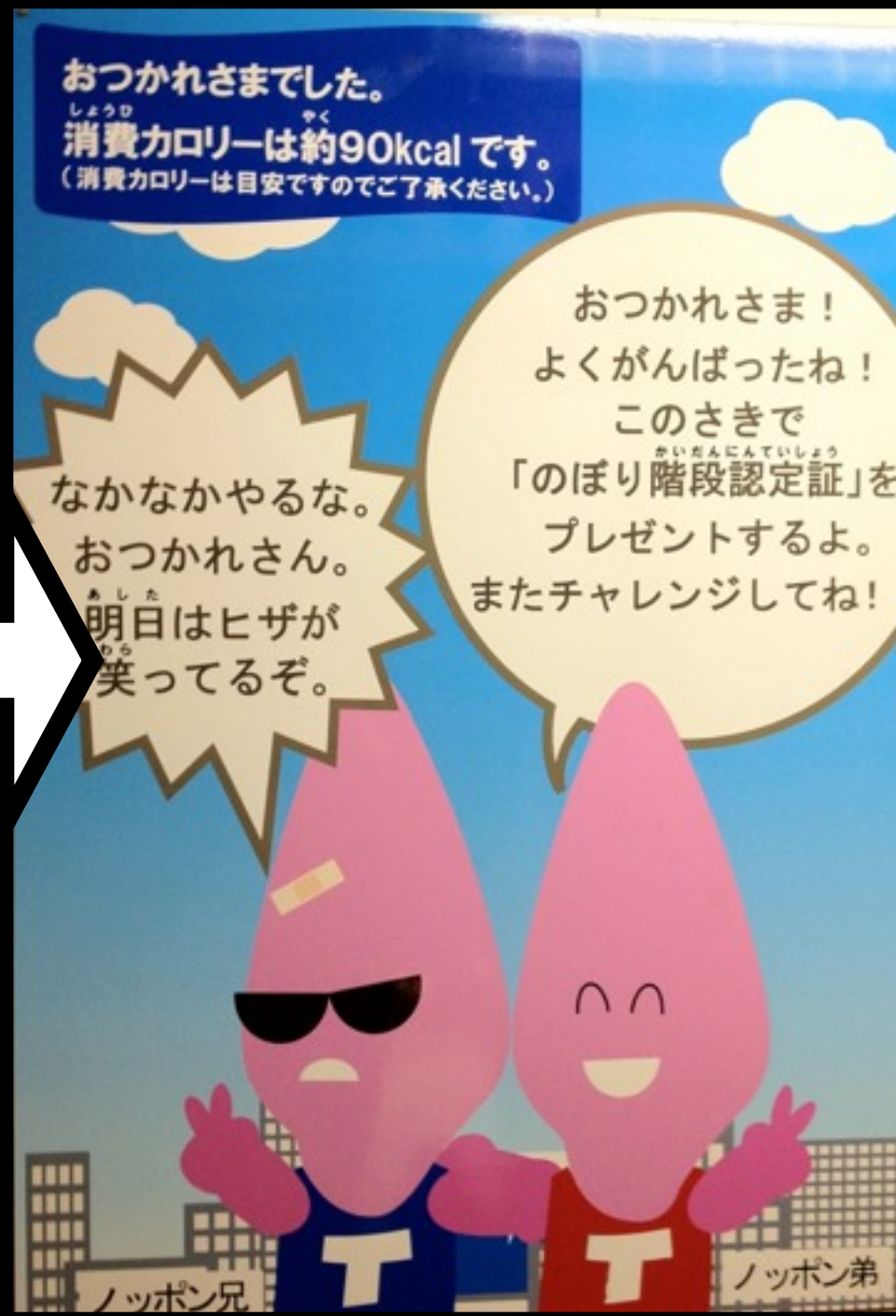
やっとここまできたか。
ここはお台場の観覧車と
同じ高さだぞ。
せっかくだから東京にむかって
なにかさけんでみたらどうだ。

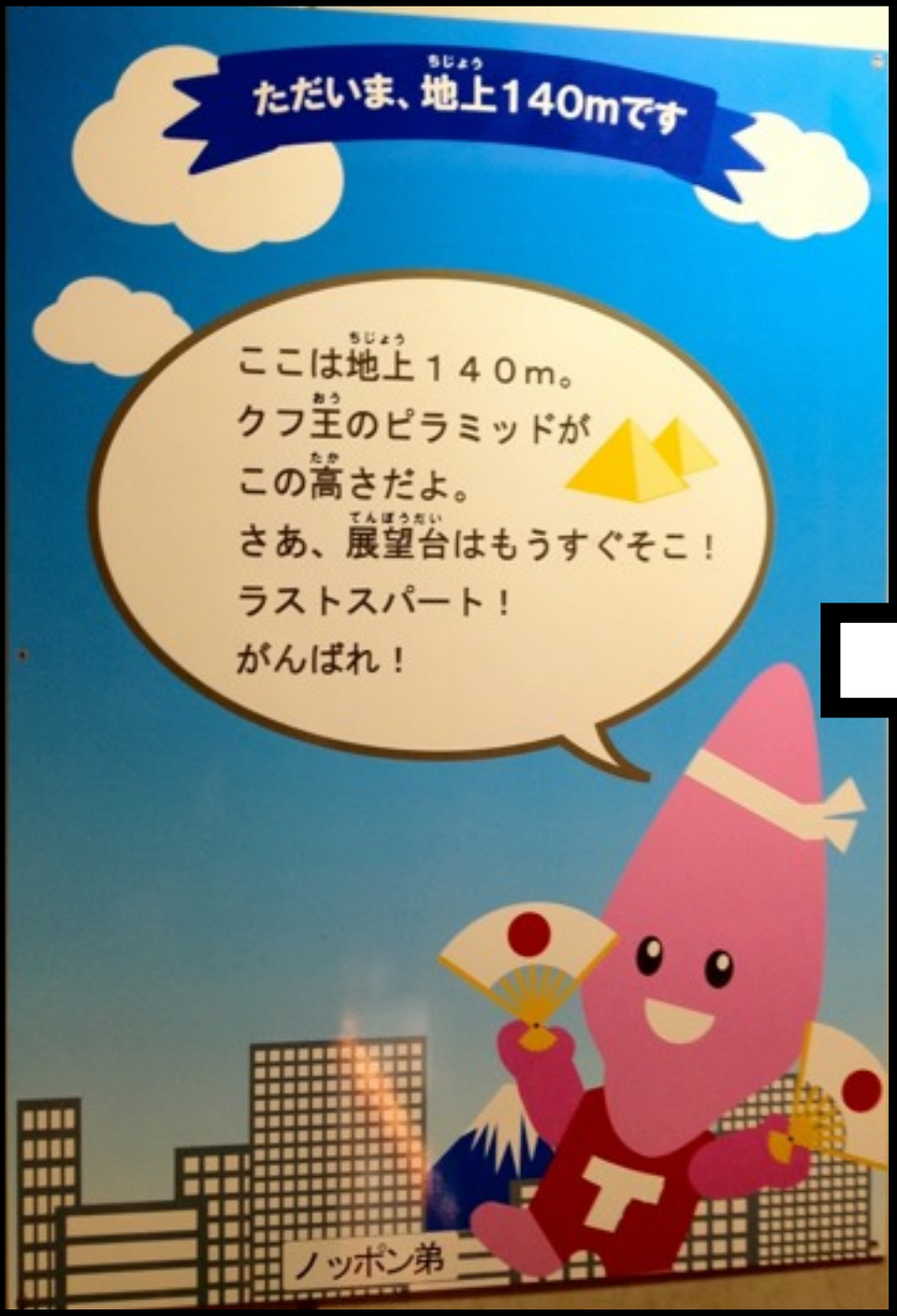
ここまでの消費カロリーは
約62kcalです。

キアイダー！

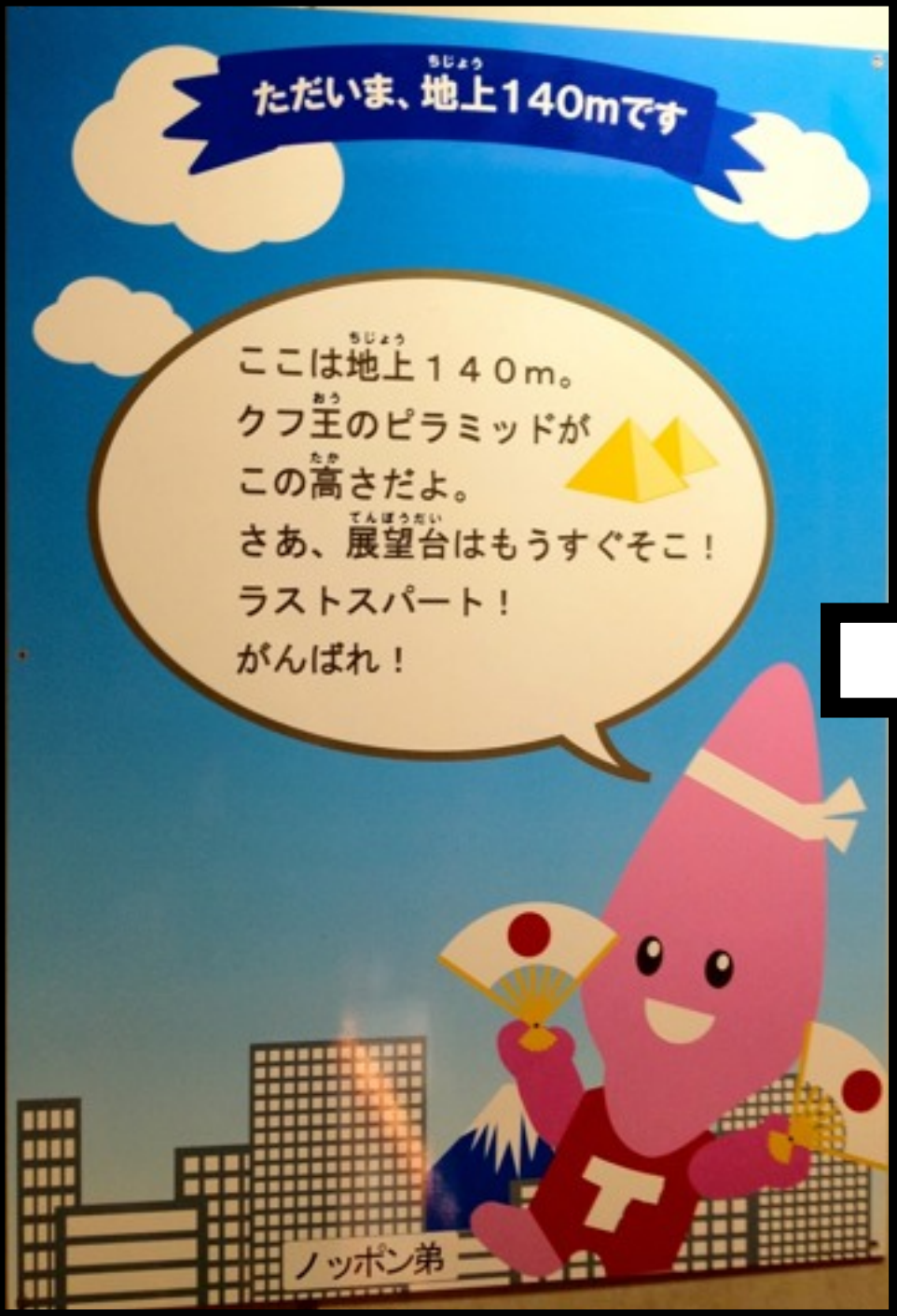
ノッポン兄


ただいま、地上140mです
ここは地上１４０m。
クフ王のピラミッドが
この高さだよ。
さあ、展望台はもうすぐそこ！
ラストスパート！
がんばれ！
ノッポン弟


おつかれさまでした。
消費カロリーは約90kcal です。
（消費カロリーは目安ですのでご了承ください。）
なかなかやるな。
おつかれさん。
明日はヒザが
笑ってるぞ。
おつかれさま！
よくがんばったね！
このさきで
「のぼり階段認定証」を
プレゼントするよ。
またチャレンジしてね！
ノッポン兄
ノッポン弟

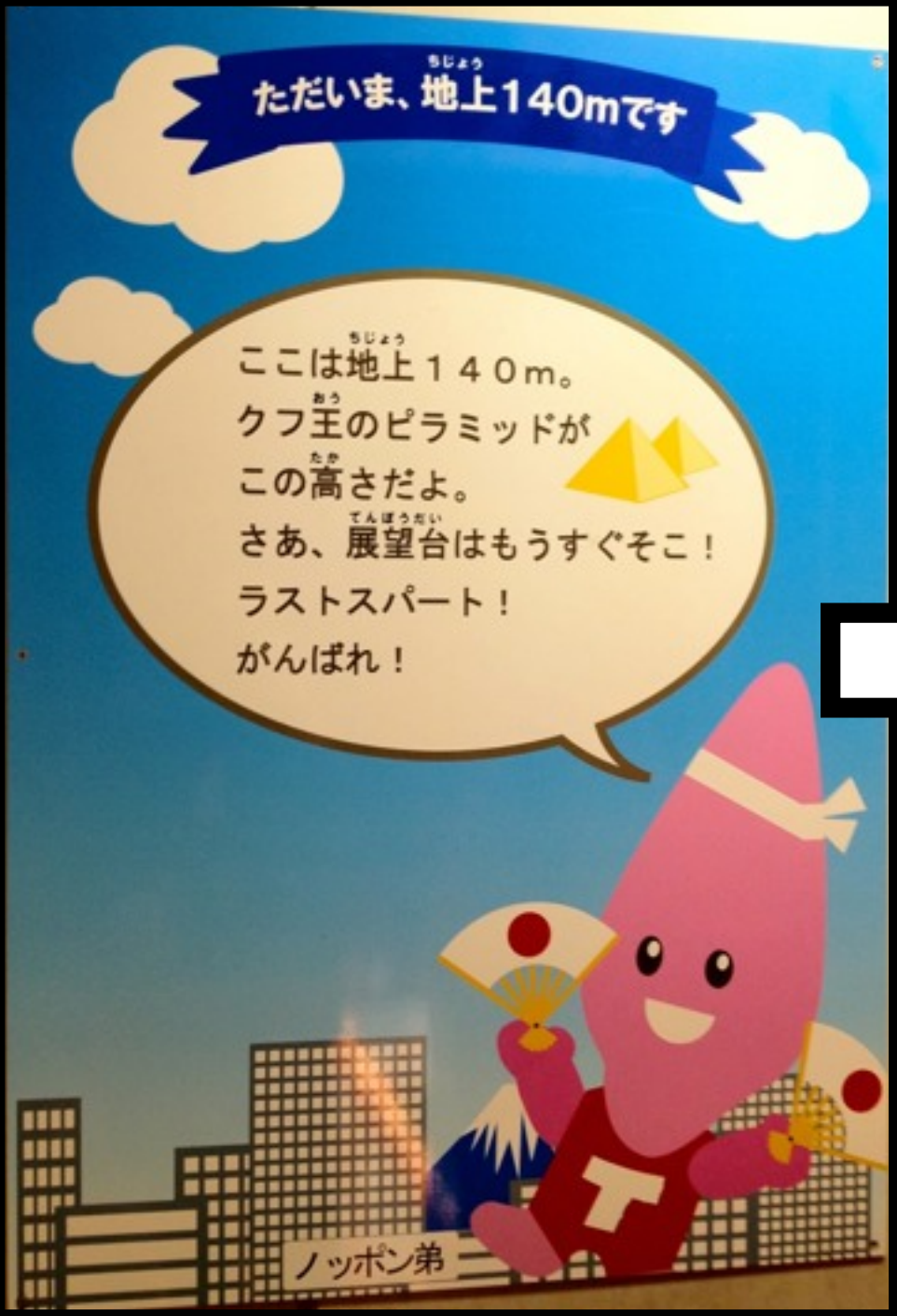

ただいま、地上140mです
ここは地上１４０m。
クフ王のピラミッドが
この高さだよ。
さあ、展望台はもうすぐそこ！
ラストスパート！
がんばれ！
ノッポン弟


Mount Fuji



Information
Peripheral
Situated (Context)
Subtle changes

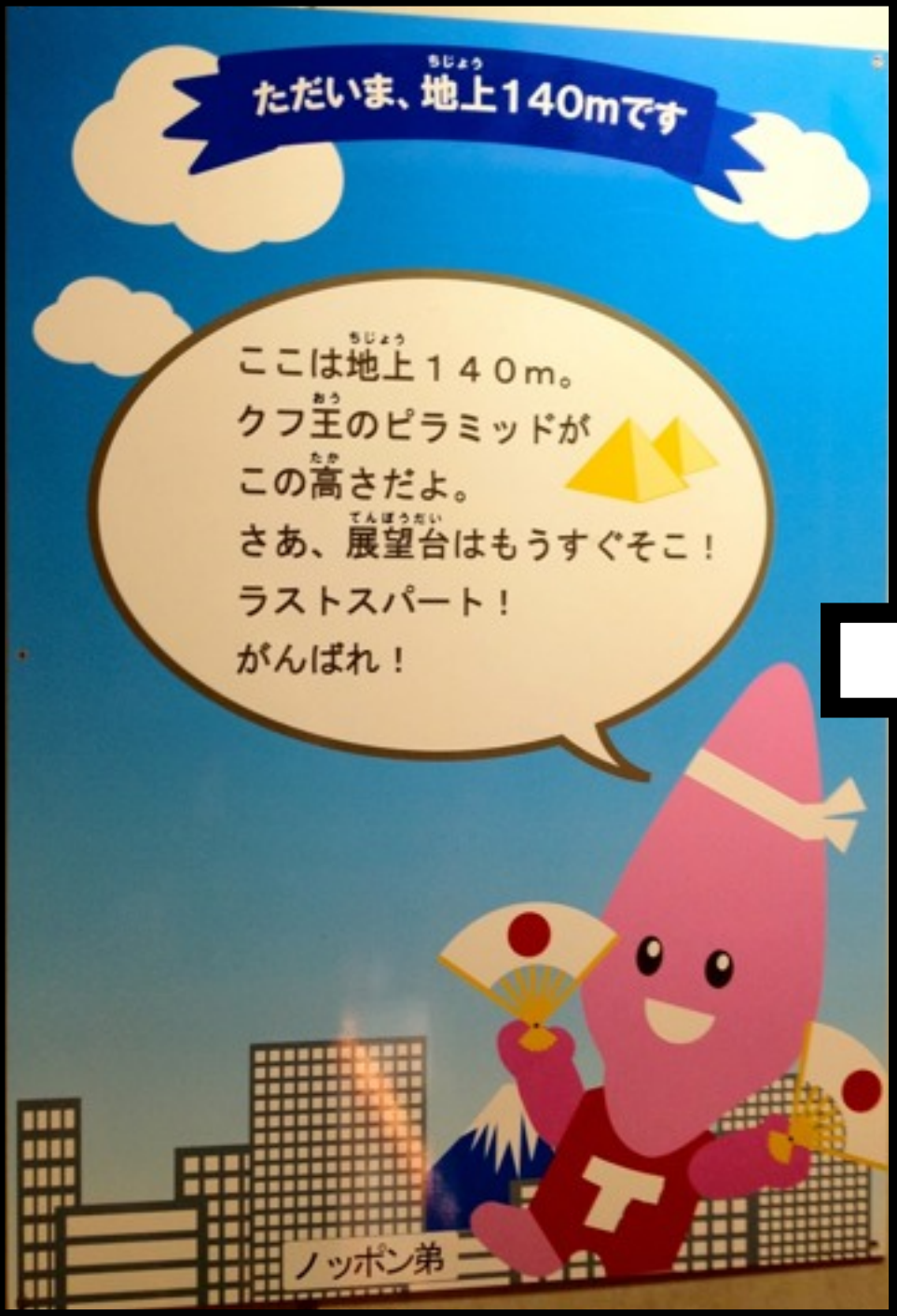
Definition



Information
Peripheral
Situated (Context)
Subtle changes

Awareness
Feedback
Motivation

Definition



Information
Peripheral
Situated (Context)
Subtle changes

Awareness
Feedback
Motivation

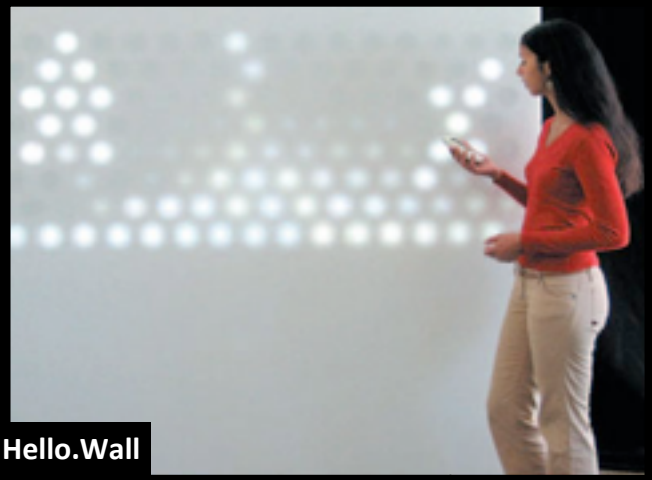
~~Digital~~
~~Context-aware~~
~~Various senses~~

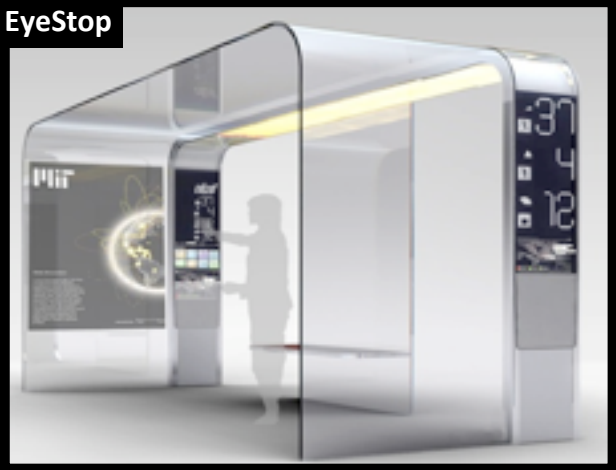
Definition

Ambient Learning Display
>>> Type

Ambient Learning Display

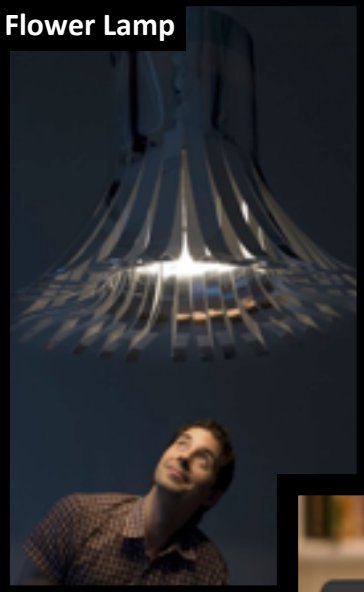
>>> Type


Hello.Wall


EyeStop


Nuage Vert


Ambient Umbrella


Flower Lamp

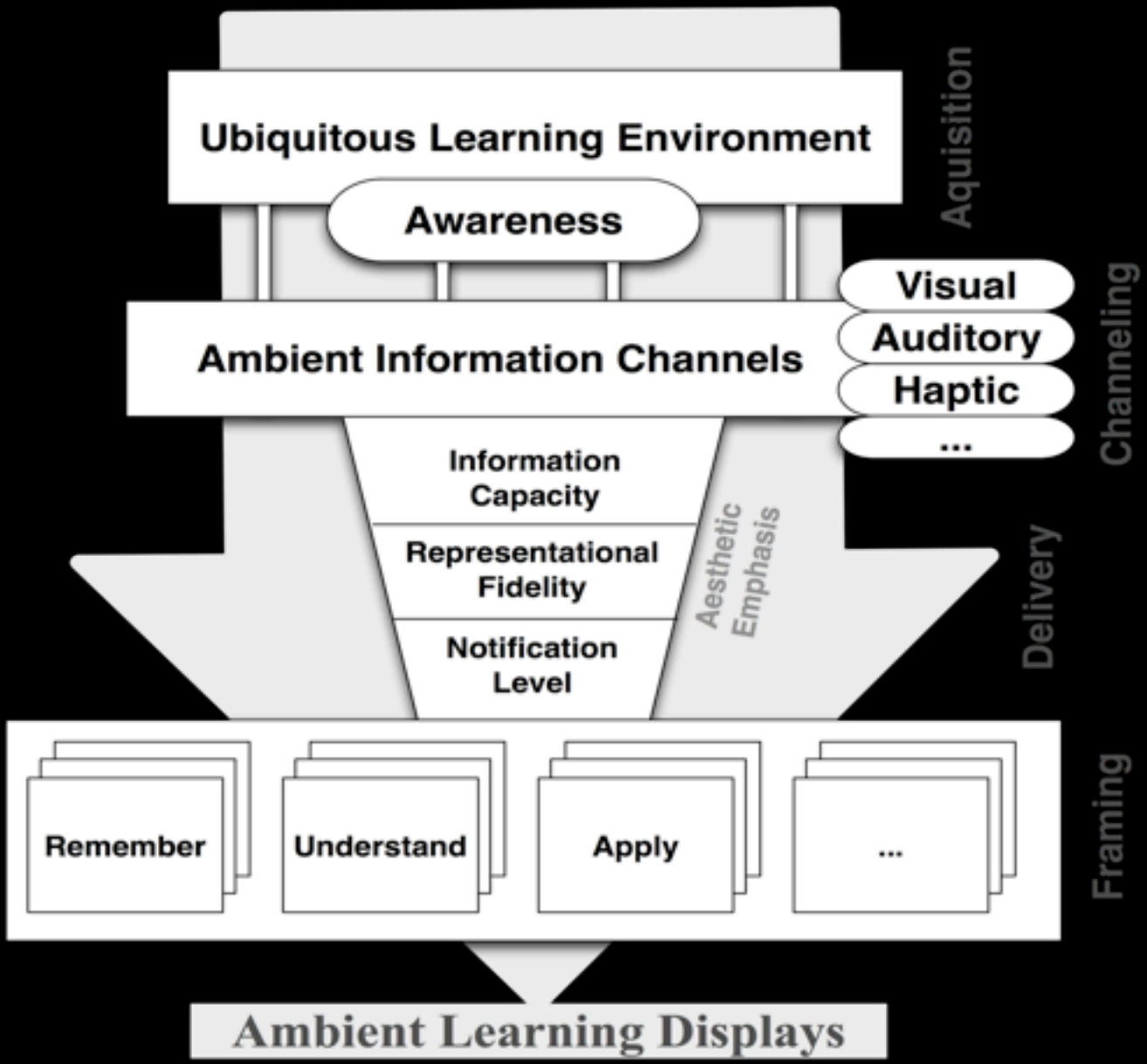

UbiGreen


Digital Retail


Power Aware Cord


Orb


BBC



Conceptual Design Framework

Börner, D., Kalz, M., & Specht, M. (2011). Thinking outside the box – a vision of ambient learning displays. *International Journal of Technology Enhanced Learning*, *3*(6), 627–642.

Theoretical Background

[http://www.wired.com/magazine/2011/06/]

1 Evidence

The radar-equipped sign flashes a car's current speed.

First comes the data—quantifying a behavior and presenting that data back to the individual so they know where they stand. After all, you can't change what you don't measure.

2 Relevance

The sign also displays the legal speed limit—most people don't want to be seen as bad drivers.

Data is just digits unless it hits home. Through information design, social context, or some other proxy for meaning, the right incentive will transform rational information into an emotional imperative.

3 Consequences

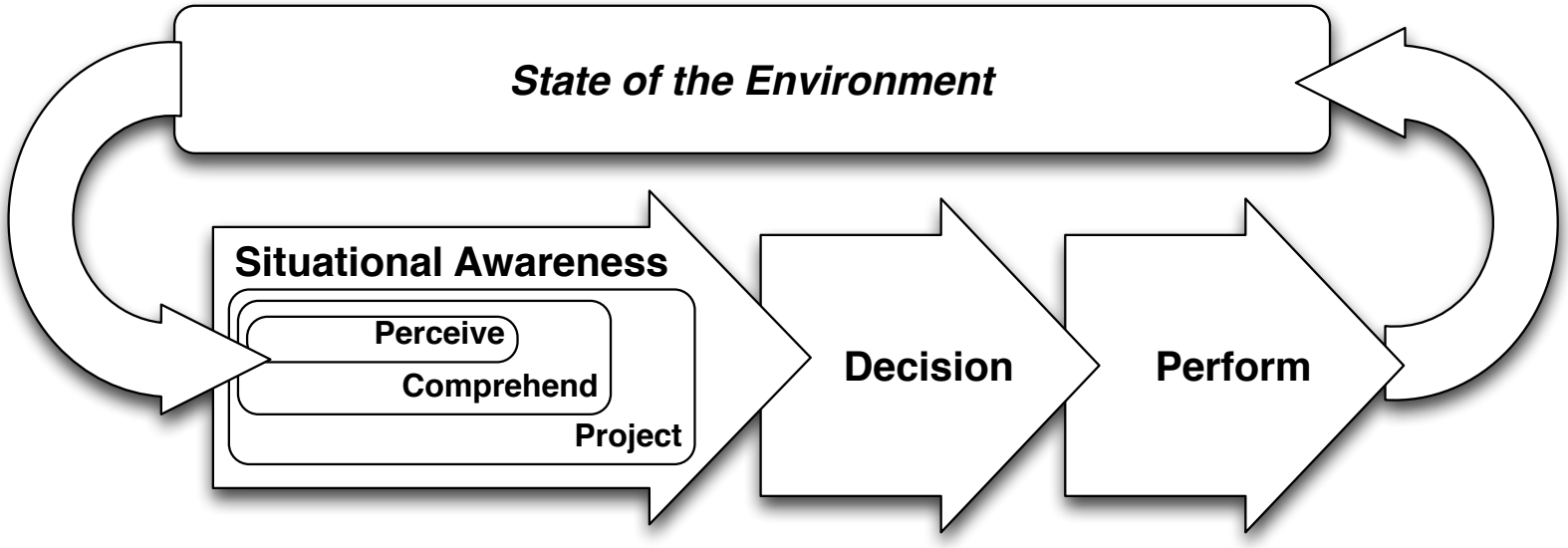
People are reminded of the downside of speeding, including traffic tickets and the risk of accidents.

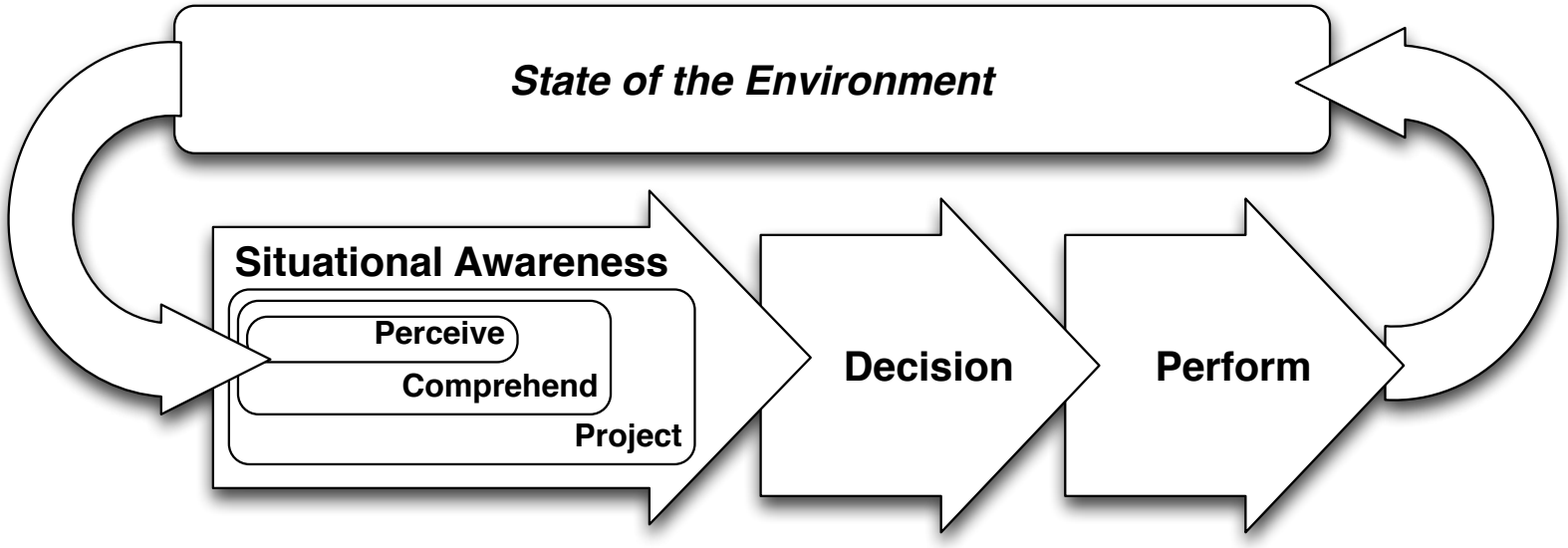
Even compelling information is useless unless it ties into some larger goal or purpose. People must have a sense of what to do with the information and any opportunities they will have to act on

4 Action

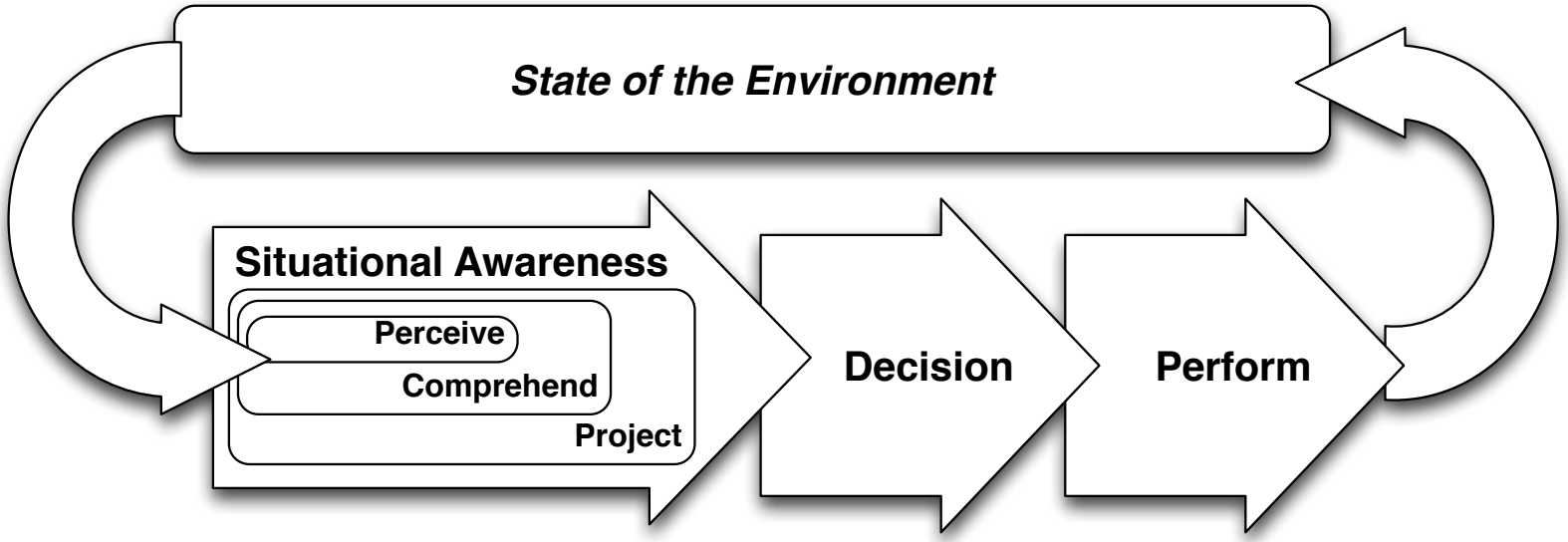
Drivers slow an average of 10 percent—usually for several miles.

The individual has to engage with all of the above and act—thus closing the loop and allowing that new action to be measured.


State of the Environment
Situational Awareness
Perceive
Comprehend
Project
Decision
Perform



Situational Awareness (Endsley, 2000): "the perception of elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future"



Situational Awareness (Endsley, 2000): "the perception of elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future"

Feedback (Mory, 2004): research variables of interest are information content and load referred to as complexity, timing, error analysis, learning outcome, and motivation

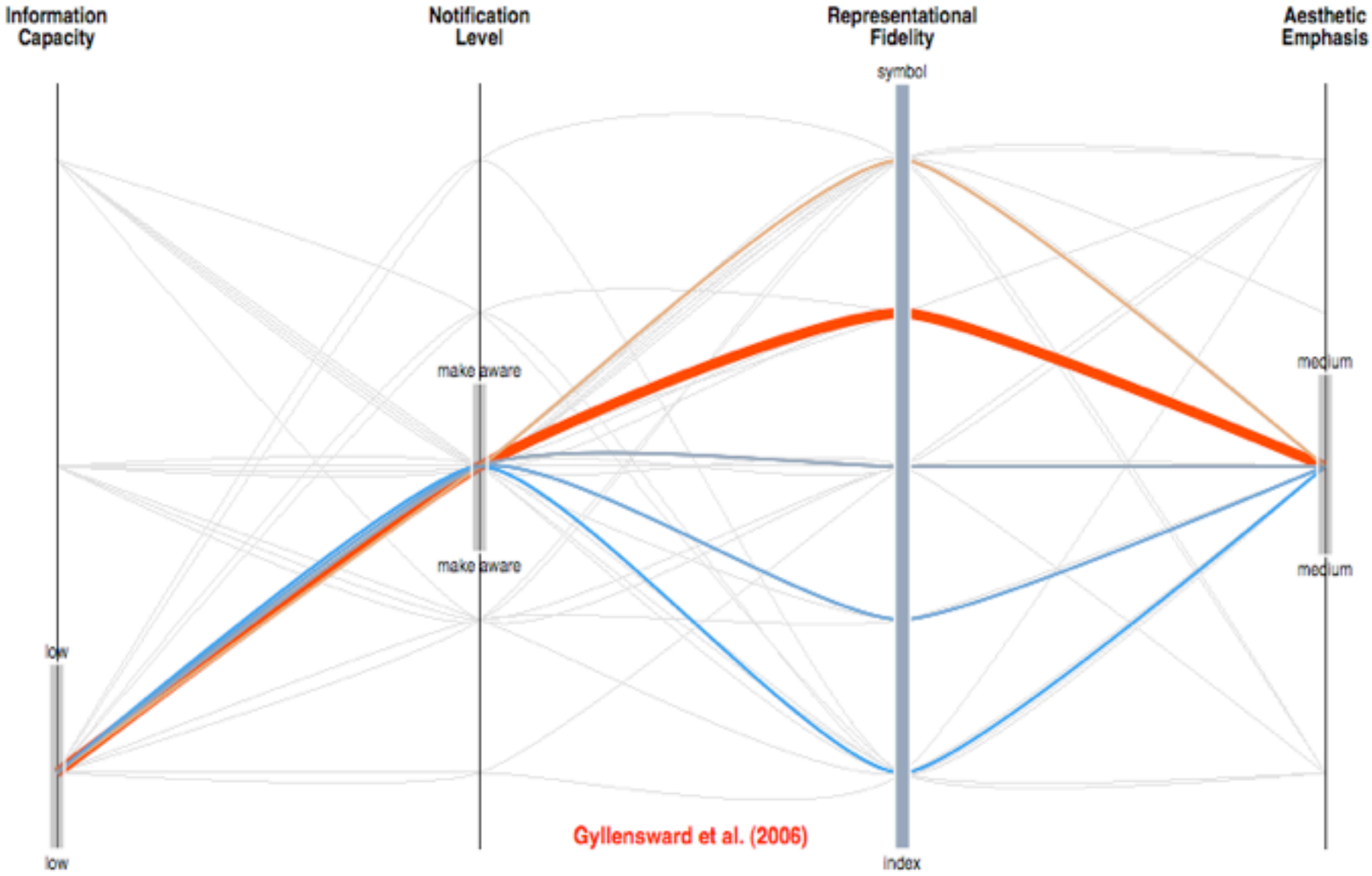
Ambient Learning Display
>>> Scenario

Ambient Learning Display
>>> Scenario


CORNING
A Day Made of Glass 2
Made Possible by Corning

http://www.youtube.com/watch?v=jZkHpNnXLB0

Pousman and Stasko (2006) introduced a taxonomy for ambient information systems describing four design dimensions [...] **information capacity** is determined by the amount of information represented by the system, **notification level** is the degree of user interruption, **representational fidelity** describes how the data is encoded, and **aesthetic emphasis** reflects the effort put into design and embedding (Pousman & Stasko, 2006).



Börner, D., Kalz, M., & Specht, M. (submitted). Closer to you: A literature review on ambient display design and evaluation. Special Issue of Interacting with Computers on the Social Implications of Embedded Systems.

		Prototype	Design Dimensions				Feedback			Learning Outcome	Result
			Information Capacity	Notification Level	Representational Fidelity	Aesthetic Emphasis	Complexity	Timing	Error analysis		
Situational Awareness	Perception	Gustafsson & Gyllenswärd, 2005 > Power-Aware Cord	Low	Make aware	Iconic	High	No feedback	Immediate	Confirmatory	Concept	Intriguing tool to investigate behaviour. Increased awareness
		Gyllensward et al., 2006 > Elements	Low	Make aware	Symbolic	Medium	No feedback	Immediate	Confirmatory	Concept	Intriguing tool to present (intangible) information
		Kim et al., 2010 > Timelog	Low	Make aware	Indexical	Medium	No feedback	Immediate	Confirmatory	Declarative	General increased awareness through unobtrusive persuasive medium; Representation less effective to change behaviour (cf. Coralog)
		Kimura & Nakajima, 2008 > Persuasive Art	Low	Make aware	Symbolic	High	Simple verification	Delayed	Corrective	Rule (Relational)	Animated emphatic visualization more pervasive and thus more effective to change behaviour
		Kuznetsov & Paulos, 2010 > Upstream 1	Low	Make aware	Symbolic	Medium	Simple verification	Immediate	Corrective	Rule (Relational)	Increased awareness led to behavioural impact facilitated through perceptual impact of ambient visualization. Numeric visualization less effective.
		Kuznetsov & Paulos, 2010 > Upstream 2	Low	Change blind	Indexical	Medium	No feedback	Immediate	Confirmatory	Declarative	
	Comprehension	Bonanni, 2006 > Hyper-Reality	Low	Make aware	Symbolic	Somewhat high	No feedback/ Simple verification	Immediate	Confirmatory	Concept	Amplifying sensor experience (motivate behaviour change)
		Consolvo, Klasnja, et al., 2008 > UbiFit Garden	Medium	Make aware	Symbolic	Somewhat high	Simple verification	Immediate/ Delayed	Confirmatory	Rule (Procedural)	Positive reinforcement; Effective for raising awareness. Potentially influencing behaviour.
		Froehlich et al., 2009 > UbiGreen	Low	Make aware	Iconic	High	Elaborated	Immediate	Corrective	Rule (Relational)	Increased engagement/encouragement facilitating behaviour change

Börner, D., Kalz, M., & Specht, M. (submitted). Beyond the channel: A literature review on ambient displays for learning. Computers and Education.

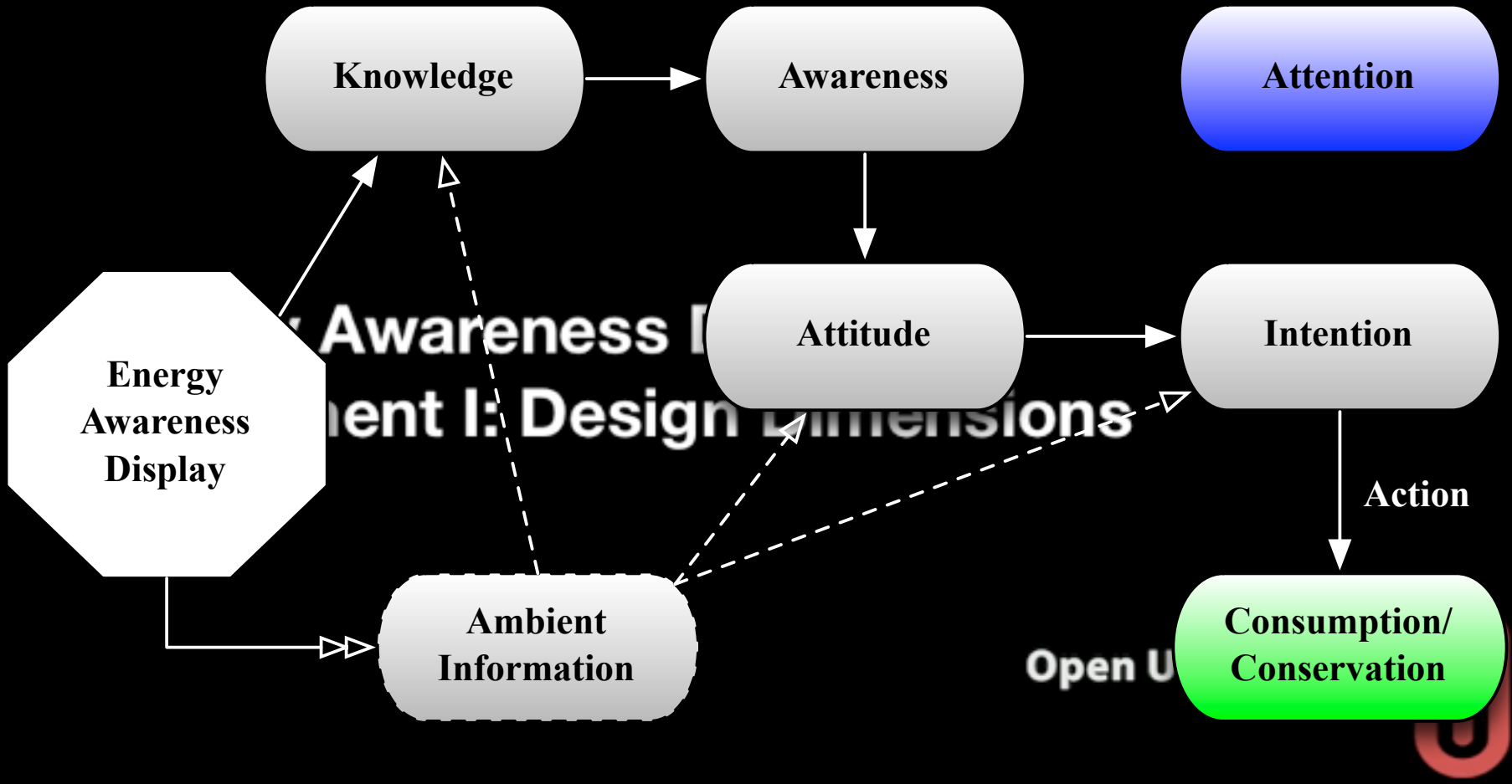
Ambient Learning Display
>>> Design

Ambient Learning Display
>>> Design

Energy Awareness Displays
Experiment I: Design Dimensions

Open Universiteit
www.ou.nl

Experiment 1



http://www.plugwise.com/


Experiment 2

Energy Awareness

Rooms | Groups

- Coffee Machines
- Printers
- Gaming Consoles
- Workplaces
- Hot Desks
- Water Coolers

Appliance(s)

- Workstation 1.27 Door
- Workstation 1.27 Window
- Workstation 1.28 Door
- Workstation 1.28 Window
- Workstation 1.39
- Workstation 1.40 Door
- Workstation 1.40 Window

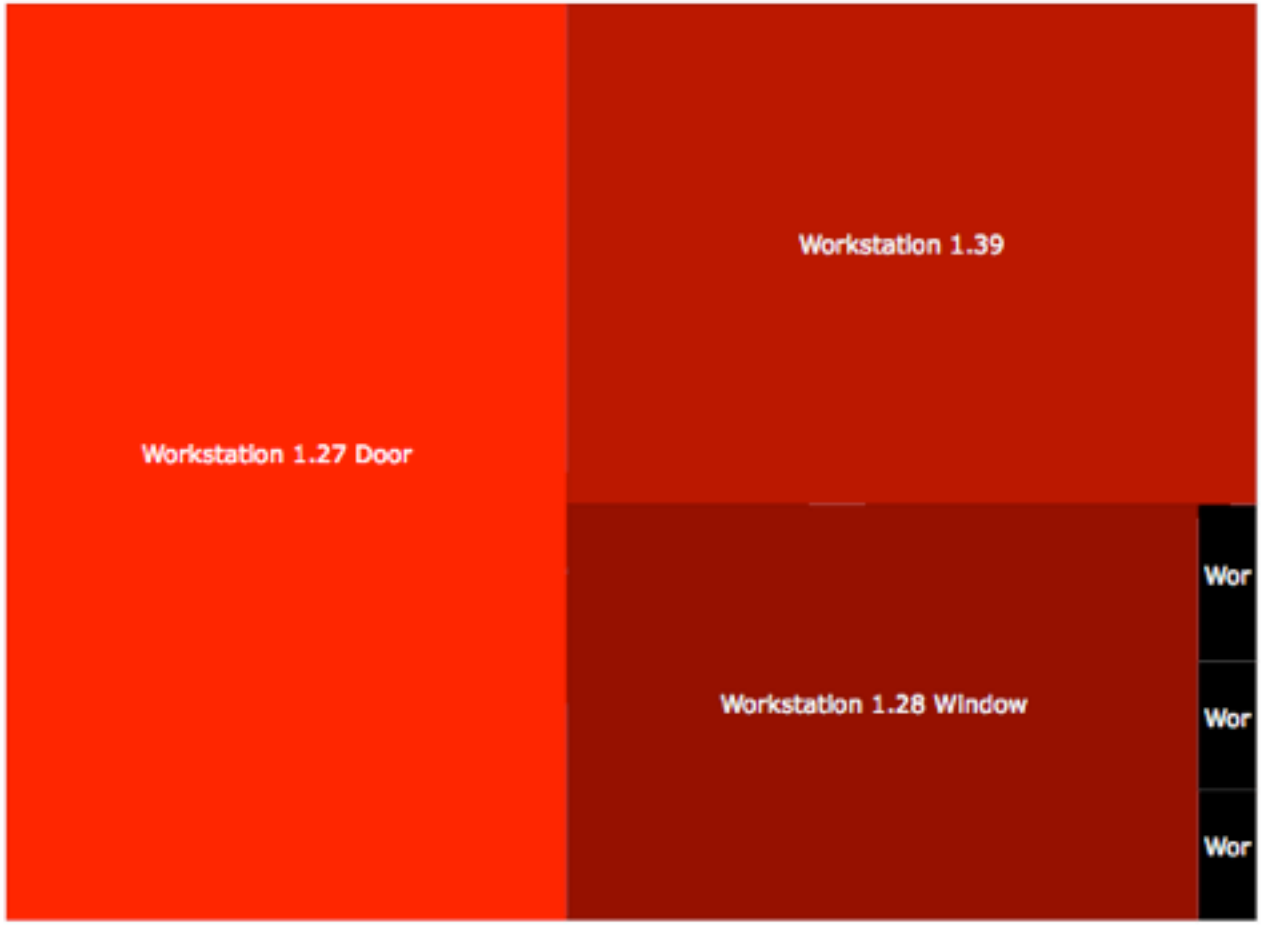
Current Usage
215 W

Hot Desks

Total Usage Today
0.91 kWh

Explore | Relate | Compare

Select a room/group to compare the appliances' consumption.



◉ Current Usage ○ Total Usage Today

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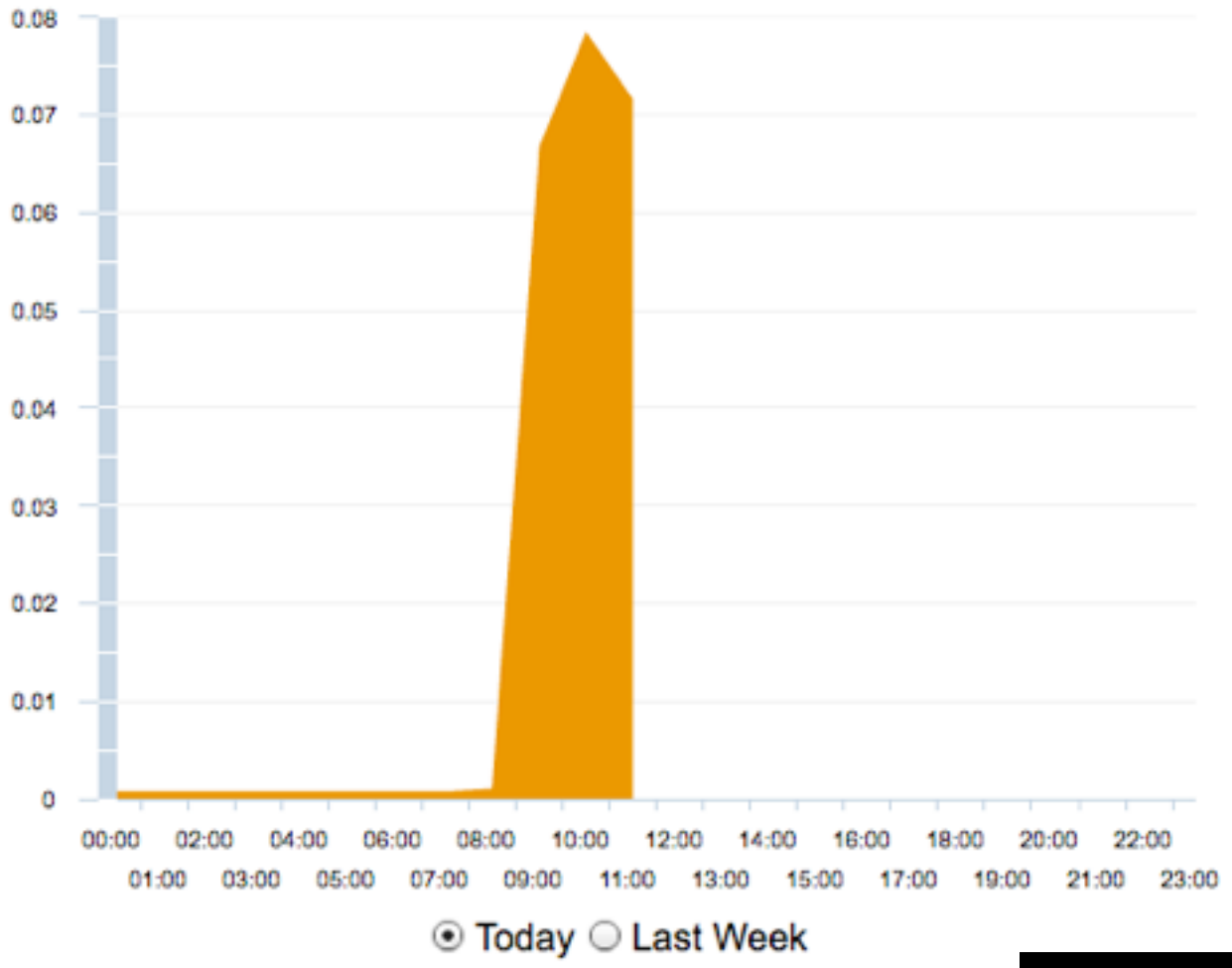
Current Usage
215 W

Hot Desks

Total Usage Today
0.91 kWh

Explore | Relate | Compare

Select an appliance to explore it's consumption.



Experiment 2

Energy Awareness

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Current Usage
215 W

Hot Desks

Total Usage Today
0.91 kWh

Explore | Relate | Compare

Select a room/group or appliance to relate it's consumption.

3674 Campus²

548 Chiba²

6.7 Employee²

0.91 Hot Desks¹

¹ Total usage today in kWh.

² Total usage in kWh/day, based on the estimated total energy consumption February 2009 - February 2010, assuming 250 working days.

Experiment 2

Experiment 3

Display design #1

Experiment 3

Experiment 3

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